STANFORD LINEAR ACCELERATOR CENTER

FY 2004 – FY2010 Comprehensive Energy Management Plan

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Stanford Linear Accelerator Center

SLAC is one of the world 's leading research laboratories. Established in 1962, it is located at Stanford University in Menlo Park, CA. Our mission is to design, construct and operate state-of-the-art electron accelerators and related experimental facilities for use in high-energy physics and synchrotron radiation research.

- Recognized internationally with 3,000 visiting scientists from US universities, national laboratories, industrial concerns and foreign countries.
- Highly trained and award winning staff of physicists, engineers, computer scientists and other professionals.
- Work recognized with three Nobel Prizes in physics.

SLAC is operated by Stanford University for the US Department of Energy

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SLAC
FY 2004 – FY 2010 CEMP

I. BACKGROUND INFORMATION

This document is a Comprehensive Energy Management Program and Plan (CEMP) for SLAC covering the period between FY 2004 and FY 2010. The purpose of this program is to provide a structure and schedule that meet all the applicable requirements listed in the DOE Order 430.2A, DEPARTMENTAL ENERGY AND UTILITIES MANAGEMENT and in accordance with a selected objectives, measures and expectations as developed by Federal Energy Management Program (FEMP). This plan will be incorporated into SLAC's performance-based agreement as appropriate for the mission of SLAC's site. The Comprehensive Energy Management Program and Plan will be updated annually to contain priority actions scheduled for implementation over the next 2 years. SLAC will provide annual assessment of performance against this agreement using graded approach.

The Site Engineering and Maintenance Department of SLAC Technical Division is chartered with managing the Comprehensive Energy Management Program and Plan. A Facilities Engineer is assigned to manage this program in accordance with established objectives and goals directly related to energy-efficient operations.

In the conduct of its research, SLAC spent $10.2 million for 368 .8 GWh of electricity and over $0.25 million for natural gas in FY 2003. To help manage these large expenditures SLAC's CEMP is directed to four major areas as follows:

- Meet DOE mandated goals;
- Meet performance-based contract objectives;
- Procure energy at the lowest cost for the required reliability;
- Improve efficiency of energy consuming systems in the most cost-effective manner.

In FY 2001 and FY 2003 SLAC achieved an "Outstanding" rating for implementation of these years energy management plans while in FY 2002 SLAC achieved "Excellent" rating for the corresponding plan based on the gradients that were in force during these years.

The SLAC's FY 2004 and FY 2005 Energy Management Plan is comprised of four (4) objectives that have been selected out of eight (8) objectives recommended by FEMP. Objectives 1, 3, 6 and 7 are included in this plan. The "required" Objective 2 is not included (see explanation in Section II below).

II. FY 2004 SPECIFIC GOALS

In FY 2004 the SLAC Site Engineering and Maintenance Department will be responsible for developing, reporting, and meeting specific energy management performance measures that are part of the Comprehensive Energy Management Program and Plan as follows:

1. Enter all energy usage data as required into the EMS4 website not later than the submission due date.

2. Prepare and submit to DOE a FY2004 Assessment Report not later than the submission due date.

3. Provide potable water use data in the FY 2004 Annual Report.

4. Implement Phase 2 of Feasibility Study for On-Site Combined Heat and Power (CHP) Plant project. When constructed, this project will generate electricity for SLAC Computer Center by means of an internal combustion engine. In FY2003 we completed Phase 1 of this study. During this phase, we compared the economics and reliability of 1.0 MW gas-burning internal combustion engine integrated with a 300-ton absorption chiller against a back-up diesel generator coupled with a dedicated electrical chiller for SLAC Computer Center operation. SLAC management evaluated and discussed the result of this study and concluded that it warrants further analysis with expanded scope of study. The Phase 2 of the study will include assessment of electrical power generation for miscellaneous critical operations of the entire site in addition to the critical loads of the Computer Center. Also, evaluation of the cost impact of the plant location will be included in this study. In addition, we plan to include search and solicitation of funding, grants and incentive/rebate programs available for this project.

5. Replace all existing obsolete fluorescent T12/electromagnetic-ballast lighting assemblies in buildings 040 and 084 with new T8/electronic ballasts, energy–efficient, assemblies. Total estimated cost of the project is $150K.

6. Design “Accelerator Housing Lighting Control Upgrade” project. The accelerator housing (2-miles long underground structure that houses the linear accelerator beam) is being illuminated by means of 100-watt incandescent light bulbs located overhead at 10-feet intervals. During the machine operation the lights are in dim mode being controlled by resistors. The resistors reduce voltage output by wasting energy with heat. We plan to modify existing lighting control to allow all the lights in the tunnel turned off during No-Access state of operation. The managers of the operation require a pilot installation for a sector-pair of the tunnel prior to implementing the entire scope of work (see related goal #7).

7. To the extent that adequate funding is made available, implement lighting control modifications at a pilot sector-pair of the “Accelerator Housing Lighting Control Upgrade” project (see related goal #6).

8. To the extent that adequate funding is made available and provided that the installation at the pilot sector is successful, implement “Accelerator Housing Lighting Control Upgrade” project for the entire linear accelerator (see related goals #6 and #7).

9. Prepare a written response on DOE consultant’s comments/questions for the previously submitted “Test Lab High-Bay Lighting Replacement” project proposal.

10. Implement “Test Lab High-Bay Lighting Replacement” project. The scope of the

project includes replacement of 80 energy-inefficient T12/magnetic ballast lighting fixtures with new, energy-efficient, T5/electronic ballast, assemblies. The total estimated cost of the project is $35.6K and the projected payback period is 2.9 years.

11. Decommission existing Low Conductivity Water (LCW) systems that service heat exchanging equipment of North and South Focusing Magnets of SLAC Linear Collider (SLC). The SLC operation has been discontinued. Expected saving on shutting down three (3) 100-amp LCW pumps is 199.5 kW or 1.7 GWH per year.

12. Replace undersized and obsolete Variable Frequency Drives (VFDs) at 10 fan motors of SLAC Computer Center (Building 050). The aggregate rated capacity of the motors is 170 HP.

13. Replace two (2) existing floor standing air-handling units on the 2nd floor of the Computer Center (Building 050) with two (2) new, energy-efficient, units. Each unit capacity is 27 tons. The air handling units have already been purchased in FY2003.

14. Implement feasibility study, conceptual design and life-cycle cost analysis of "North and South Arc Tunnels Lighting Control" project.

15. Install Variable Frequency Drive (VFD) at 125 HP fan motor of CT 1701.

16. Complete "Waste Water Recycling" project. This project includes installation of new 12,000 gal holding tank for storage of collected waste water as an addition to the existing mobile water treatment unit. The waste water is being delivered by a vacuum truck that collects waste water from different sources such as transformers' secondary containments, underground vaults, etc. The recycled water will be used for cooling tower 1701 water make up.

17. Replace existing PH and/or conductivity sensors and Strantrol controllers with new sensors and PLC controllers at least three (3) out of six (6) cooling towers: 101, 1200, 1201, 1202, 1701 and 404. The new control system will be connected to existing Honeywell Scan DCS (Distributed Control System). The system will allow remote monitoring and reset of the automatically controlled system's parameters therefore allowing to optimize the blow-down cycles.

18. Install a water meter at Central Plant hot water system make-up water pipe.

19. Design replacement of all existing banks of cooling coils and seven (7) supply- and return-air fans of the central air conditioning system serving Computer Center of Building 050. The existing 30-years old, scaled and rusted energy-inefficient equipment will be replaced with new, energy-efficient, equipment. (The total estimate cost of the project is $461K and actual construction is planned to be implemented in FY2005.)

20. Purchase six (6) additional Neighborhood Electrical Vehicles (NEV) in FY2004. (In FY2003 15 NEVs have been purchased by SLAC.) The battery-operated NEVs allow SLAC to discontinue lease of some of GSA gasoline-powered vehicles.

21. Implement Title 1 design of "Underground Mechanical Utilities Replacement" project. This goal includes Title 1 design of underground piping replacement for natural gas, compressed air, cooling-tower water, chilled water and hot water systems. These systems developed significant leaks that cause waste of energy and impose additional maintenance cost. The proposed work includes replacement of identified mains and branches known or suspected of leaking. (Estimated cost of design and replacement of underground piping for these five (5) systems is $2,812,147. Title 2 Design and actual construction of the project is scheduled for implementation in FY2005/2006.)
22. Submit at least one article on the subject of energy management to Interaction Point, SLAC's publication.
23. SLAC Energy Manager to attend at least one energy management workshop, seminar or conference.
24. Continue improving/upgrading the Energy Management website.
25. Distribute DOE energy-awareness posters and other outreach materials to SLAC building managers for displaying in public places.
26. Procure of microcomputers and peripheral equipment through Basic Ordering Agreements (BOAs) negotiated by DOE ICPT (Integrated Contractor Purchasing Team) in compliance with Energy Star criteria.
27. Continue providing information and assistance in the forming of ride-sharing pools as well as information regarding mass transit and bicycle path through the SLAC Transportation Coordinator. Where operations permit, allow flexible work hours for participation in ride-sharing programs.
28. Continue providing bus service to and from Cal-Train station in Palo Alto in accordance with schedule that allow employees to commute on public transportation.
29. Update laboratory's CEMP by March 31, 2004.
30. Develop a Water Management Plan that includes at least four (4) BMPs; implement elected BMPs.
31. Modify acquisition systems to facilitate the purchase of low standby power devices.
32. Conduct an Assessment of Load and Energy Reduction Techniques (ALERT) at site.
33. Update a Site Specific Peak Load Management/Emergency Conservation Plan by June 30, 2004.
34. Develop work plans to implement Peak Load Management/ Emergency Conservation Plans and Alert Assessments recommendations.

III. LONG TERM GOALS

To ensure that there are adequate systems in place to meet the goals defined in the DOE ORDER 430.2A DEPARTMENTAL ENERGY AND UTILITIES MANAGEMENT, long term goals have been defined for the applicable requirements of the DOE Order 430.2A as follows:

1. Implement life cycle cost-effective improvements, as identified during facility energy audits on an annual basis as funding is made available.

2. Implement water management through water efficiency program in accordance with Objective 3 of Section II - Develop and Implement Water Efficiency Program and Plans (see Attachment 1).

3. Demonstrate annual progress toward completing energy and water audits of all non-experiment-dedicated facilities.

4. Apply sustainable design principles to new buildings. Comply with 10 CFR 434, Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for Federal Buildings, from conceptual design through commissioning. Although not mandatory, energy efficiency and sustainable design principles will be considered when designing building alterations for the benefit of reduced life cycle costs and enhanced occupant satisfaction.

5. Evaluate designating SLAC Visitor Center as Showcase Facilities to highlight renewable energy improvements.

6. Continue using existing acquisition system that promotes selection of DOE/EPA Energy Star ® products. This system was set up in FY 2003. It includes a questionnaire on Energy Star ® labeled products incorporated in the Laboratory's on-line purchase requisitioning system and addition of Article 62: "Energy-Efficient Products" into the Laboratory's General Terms & Conditions for Fixed Price Construction Contracts.

7. Implement Objective 6 - Purchases of energy efficient technologies include low standby power devices (see Attachment 1).

8. Continue procurement of microcomputers and peripheral equipment through Basic Ordering Agreements (BOAs) negotiated by DOE ICPT (Integrated Contractor Purchasing Team) in compliance with Energy Star ® criteria.

9. Continue implementing existing Preventive Maintenance Program that includes identification and correction of energy conservation operational and maintenance deficiencies that are correctable at low cost.

10. Increase use of alternative funding mechanisms in lieu of direct appropriations for energy efficiency improvements consistent with good business practices.

11. Increase number of trained energy managers as needed to ensure effective implementation of DOE orders requirements.

12. Implement feasibility studies that include off-grid generation systems. Implement the projects that demonstrate that such systems are life-cycle cost effective and offer other benefits.

13. Control electric, gas, and water loads to minimize utilities costs and mitigate the impact of sudden disruptions in the supply of energy in accordance with Objective 7 - Control electric, gas, and water demand to control costs and mitigate supply disruptions (see Attachment 1).

14. Continue annual performance evaluations of SLAC Energy Manager to assess energy management activities and ability of the laboratory to meet provisions of DOE Order 430. 2A.

15. Develop and implement outreach programs to motivate employees to modify behavior to become more efficient in their use of energy and water and to minimize waste.

16. Continue providing information and assistance in the forming of ride-sharing pools as well as information regarding mass transit and bicycle path through the SLAC Transportation Coordinator. Where operations permit, allow flexible work hours for participation in ride-sharing programs.

17. Continue providing bus service to and from Cal-Train station in Palo Alto in accordance with schedule that allow employees to commute on public transportation.

I. ENERGY MANAGEMENT PERFORMANCE-BASED OBJECTIVES AND MEASURES FOR FY 2004 and FY 2005

The SLAC's FY 2004 and FY 2005 Energy Management Plan is comprised of four (4) objectives that have been selected out of eight (8) objectives recommended by FEMP. Objectives 1, 3, 6 and 7 are included in this plan. The "required" Objective 2 is not included (see explanation in Section II below).

OBJECTIVE 1

Energy Management initiatives are managed consistently with a Comprehensive Energy Management Program and Plan that includes the minimum requirements of Department of Energy (DOE) O 430.2A, Departmental Energy and Utilities Management.

MEASURE 1

Comprehensive Energy Management Program and Plan (CEMP) have been updated to include minimum requirements of DOE O 430.2A.

FY 2004 EXPECTATION 1

1. Energy requirements accomplished/requirements scheduled to be accomplished during the Fiscal Year in accordance with the CEMP $\geq$ 0.75.

Gradient:

Far exceeds expectations	$\geq$ 0.95
Exceeds expectations	$\geq$ 0.85
Meets expectations	$\geq$ 0.75
Needs improvement	< 0.75

2. Laboratory CEMP updated by March 31, 2004.

Gradient:

Far exceeds expectations: CEMP updated by January 31, 2004.
Exceeds expectations: CEMP updated by February 28, 2004.
Meets expectations: CEMP updated by March 31, 2004.
Needs improvement: CEMP updated after March 31, 2004.

FY 2005 EXPECTATION 1

Energy requirements accomplished/requirements scheduled to be accomplished during the Fiscal Year in accordance with the CEMP $\geq$ 0.75.

Gradient:

Far exceeds expectations	$\geq$ 0.95
Exceeds expectations	$\geq$ 0.85
Meets expectations	$\geq$ 0.75
Needs improvement	< 0.75

OBJECTIVE 3
Develop and Implement Water Efficiency Program and Plans.

MEASURE 3
Establish a Water Efficiency Program and Plan to implement at least 4 of the Best Management Practices (BMP) published by the Federal Energy Management Program (FEMP) for facility planning processes and operations.

FY 2004 EXPECTATION 3
1. Provide potable water use for each site in the FY 2003 Annual Report to the President/Congress on Energy Management; and
2. Provide a Water Management Plan and demonstrate the implementation of at least four BMP at 10 percent of the total site square footage that is not a part of the experiment-dedicated facilities.

Gradient:
Far exceeds expectations: $\geq$ 40 percent
Exceeds expectations: $\geq$ 20 percent
Meets expectations: $\geq$ 10 percent
Needs improvement: < 10 percent

FY 2005 EXPECTATION 3
1. Provide potable water use for each site in the FY 2004 Annual Report to the President/Congress on Energy Management; and
2. Provide an additional Water Management Plan and demonstrate implementation of at least four BMP at 20 percent of the site square footage that is not a part of the experiment-dedicated facilities.

Gradient:
Far exceeds expectations: $\geq$ 50 percent
Exceeds expectations: $\geq$ 30 percent
Meets expectations: $\geq$ 20 percent
Needs improvement: < 20 percent

Note: Demonstrating implementation means identifying the operations and maintenance options of the BMP that have been put into practice, and identifying retrofit/replacement options that have been installed as a result of audits.

OBJECTIVE 6
Purchases of energy efficient technologies include low standby power devices.

MEASURE 6
FEMP recommended purchasing low standby power devices.

FY 2004 EXPECTATION 6
Acquisition systems were modified to facilitate the purchase of low standby power devices by September 30, 2004.

FY 2005 EXPECTATION 6
Demonstrate by example the purchase of low standby power devices from 5 of the 10 device types.
Gradient:

Far exceeds expectation	$\geq$ 10
Exceeds expectation	$\geq$ 7
Meets expectation	$\geq$ 5
Needs improvement	< 5

OBJECTIVE 7
Control electric, gas, and water demand to control costs and mitigate supply disruptions.

MEASURE 7
Peak Load Management/Emergency Conservation Plans are developed/updated as part of the CEMP to minimize the effects of supply disruptions, and to control costs.

FY 2004 Expectation 7
1. An Assessment of Load and Energy Reduction Techniques (ALERT) assessment and training conducted at the site; and
2. A Site Specific Peak Load Management/Emergency Conservation Plan is updated by June 30, 2004; and
3. Develop work plans to implement peak Load Management/ Emergency Conservation Plans and Alert Assessments recommendations by September 30, 2004.

FY 2005 Expectation 7
1. Demonstrate that total costs for demand charges and/or actual peak demand is reduced due to activities related to Site Specific Peak Load Management/Emergency Conservation Plan. (Due to lack of metering capability at SLAC, this expectation has been altered.)
2. Work plan items from Alert Assessments/Peak Load Management Plans accomplished/work plan items scheduled to be accomplished > 0.50.

Gradient:

Far exceeds expectation	$\geq$ 0.90
Exceeds expectation	$\geq$ 0.75
Meets expectation	$\geq$ 0.50
Needs improvement	< 0.50

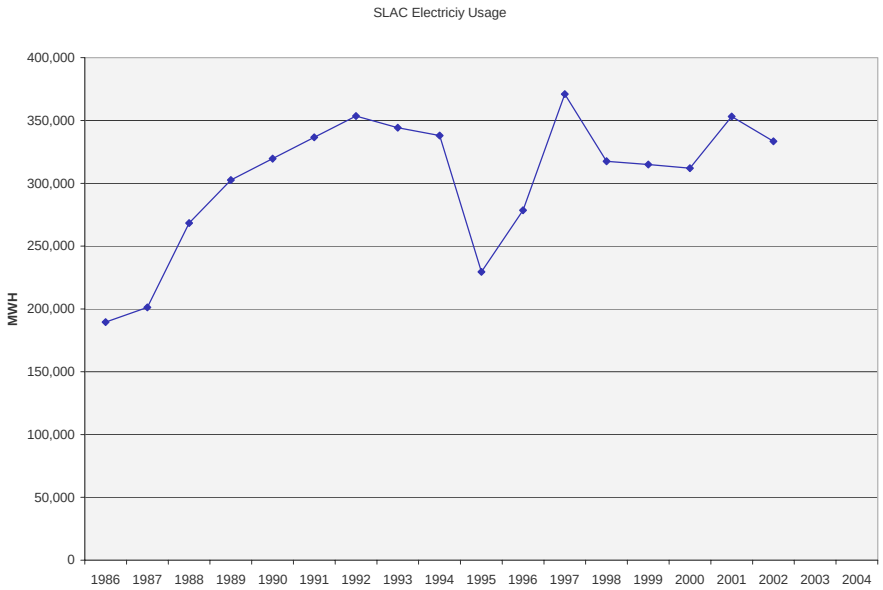
II. WAVER JUSTIFICATION FOR OBJECTIVE 2

<u>Objective title:</u> Energy Use Reductions and Green House Gas Reductions show continuous improvement and are on target toward meeting DOE energy efficiency leadership goals consistent with DOE O 430.2A.

<u>MEASURE 2</u>
((PY - CY) / PY) x 100 = percent reduction
where PY = previous year energy use per gross square foot and CY = current year energy use per gross square foot as reported in DOE's Energy Management System 4.

This objective is not a part of this plan due to the following:

1. In FY 2002 DOE FEMP made a decision to migrate the entire site into the "Industrial and Laboratory" category. About 80% of total site electrical power consumption is related to experiment-dedicated loads for the high energy physics and synchrotron radiation experimental research facilities. The facilities that contain the experiment-dedicated equipment fit the definition of "Exempt" category. The energy requirements and operations schedule of SLAC experiments vary from year to year (see graph below); therefore, the reduction of energy consumption by SLAC, compared with a base (or any year), cannot be attributed to energy conservation alone. The remaining facilities fit the definition of "Standard Buildings". The mission-driven process energy use, such as that consumed by SLAC's accelerators and beam lines, cannot be separated from the household loads with the existing metering capability. SLAC does not have accurate data for 1990 (or any other year) as the base year because of the lack of comprehensive sub-metering throughout the site.



2. In 2001 SLAC offered a sophisticated proxy measure to report the energy consumption in the “Standard Building” and “Exempt” categories, but it was not accepted by FEMP because it would not have been sufficiently accurate.

3. Since 1990 SLAC implemented many energy conservation projects and has achieved significant reduction in energy consumption. The estimated total cost of these projects is $8.3 million.